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$$FF' = \frac{1}{2}z, F'D = \sqrt{(FD^2 + FF'^2)} = \sqrt{\left\{ \left[\sqrt{(x^2 + y^2) \div 2m - z} \right]^2 + \frac{1}{4}x^2 \right\}}.$$

Now if $2FG = DK$ represent the weight, w , of the rod, FR will be the resultant of pressure FC and friction RC at R , and FF' and $F'D$ will represent the pressure and friction at D . Hence

$$\frac{F'D}{FF'} = \frac{\sqrt{\left\{ \left[\sqrt{(x^2 + y^2) \div 2m - z} \right]^2 + \frac{1}{4}x^2 \right\}}}{\frac{1}{2}z} = m'. \quad (2)$$

Eliminating y from (2) by (1),

$$\frac{\left[\sqrt{(l^2 - z^2) \div 2m - z} \right]^2 + \frac{1}{4}x^2}{l^2 - x^2 - z^2} = 4m'^2,$$

which is the equation of the locus of the upper end of the rod in all its positions of equilibrium on the supposition that the lower end is always in the axis of y .

PROBLEMS.

211. BY W. E. HEAL.—Prove that every number is either a triangular number or is the sum of two, or of three triangular numbers.

212. BY E. B. OPDYCKE, PULASKI, OHIO.—One half of a circular tract of land is cut off by an arc of a circle whose center is in the circumference of the circular tract. Find the radius with which the arc is described.

213. BY GEO. H. HARVILL, BONNER, LA.—Upon the three sides of any triangle construct equilateral triangles and join their centers by right lines. Prove that the triangle so formed is equilateral.

214. BY G. SHAW, KEMBLE, ONT., CANADA.—Prove that

$$\frac{1}{\tan A + 1} \frac{1}{\tan A + \&c.} = \frac{1}{2} [\sqrt{(\sec^2 A + 3)} - \tan A].$$

215. BY PROF. BEMAN.—A harbor A is so situated with reference to two headlands B and C , that the angle BAC is a right angle. A ship sails in a course making an angle of 55° with AB , to D , when $DB = DC$: she then sails forward on the same course 15 ms. to E , when BEC is a straight line. Required AB , AC , DB , EB and EC .

216. BY PROF. SCHEFFER. Through three given points to describe the maximum ellipse.

217. BY PROF. W. W. HENDRICKSON.—The hypotenuse of a right triangle is fixed, and squares are described upon the other two sides: it is required to find the equation to the locus of the intersection of two straight

lines, drawn from either extremity of the hyp. to the most distant corner of the square upon the opposite side. Find also the area of the curve.

218. (BY REQUEST)—Required the separate rates of dividend of two insolvent estates connected actually as follows:

John Doe's Estate. Direct liabilities \$33,425.61, also endorsements for Richard Roe \$34,949.16, less primary dividend to be paid from Roe's estate. Net proceeds to be divided \$12,395.76.

Richard Roe's Estate. Direct liabilities \$46,212.00, also endorsements for John Doe \$9,500.00, less primary dividend to be paid from Doe's estate. Net proceeds to be divided \$9,493.25, augmented by dividend on \$4,796.65 account due from John Doe's estate.

219. BY PROF. KERSHNER. — What is the locus generated by the vertex of a right angle, including sides given, sliding between the branches of a given parabola?

220. BY ARTEMAS MARTIN.—Through a given point in the surface of a circle, a chord is drawn at random. If another chord be drawn at right angles to the first, what is the probability that they will intersect?

QUERY. BY GEO. M. DAY, LOCKPORT, N. Y.—It is stated by Prof. Jevons in his "Principles of Science" that Prof. Clifford has found a function which approaches infinity as the variable approaches a certain limit; yet at the limit the function is finite. What is the function?

PUBLICATIONS RECEIVED

The Observatory, (May and June Nos.) A Monthly Review of Astronomy. Edited by W. H. M. CHRISTIE, M. A. Taylor and Francis, London, England.

The Electric Constitution of Our Solar System. By JACOB ENNIS. 8vo. 19 pp. Philadelphia. 1878.

ERRATA.

On page 93, line 10, the brace, which includes the numerator and denominator of the last term, should only include the numerator; and on same page, lines 10 and 11 from bottom should read as on page 92, lines 2 and 3 from bottom.

On page 102, line 3 from bottom, after =, insert $1 \div ap$.

" " 112, " 16, for when, read where.

" " " 17, for = read being.

" " " last line, for four roots, read, four real roots.

" " 116, for e, f, g , on wood-cut, read E, F, G .